CRM 88-155 / November 1988

RESEARCH MEMORANDUM

UTILIZATION OF PERSONNEL RESOURCES WITHIN THE NAVY SELECTED RESERVE

Peter F. Kostiuk
Dean A. Follmann
Martha E. Shiells

A Division of CNA Hudson Institute

CENTER FOR NAVAL ANALYSES

4401 Ford Avenue • Post Office Box 16268 • Alexandria, Virginia 22302-0268

Work conducted under contract N00014-87-C-0001.

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION UNCLASSSIFIED	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION / AVAILABILITY OF REPORT Approved for Public Release; Distribution unlimited.
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) CRM 88-155	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION Center for Naval Analyses 6b. OFFICE SYMBOL (If applicable) CNA	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) 4401 Ford Avenue Alexandria, Virginia 22302-0268	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING ORGANIZATION Office of Naval Research 8b. OFFICE SYMBOL (If applicable) ONR	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER N00014-87-C-0001
8c. ADDRESS (City, State, and ZIP Code) 800 North Quincy Street Arlington, Virginia 22217	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. 65154N; PROJECT NO. R0148; TASK NO.; WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) Utilization of Personnel Resources Within the Navy Selected Reserve	
12. PERSONAL AUTHOR(S) Peter F. Kostiuk, Dean A. Follmann, Martha E. Shiells	
13a. TYPE OF REPORT Final	13b. TIME COVERED FROM TO
14. DATE OF REPORT (Year, Month, Day) November 1988	15. PAGE COUNT 23
16. SUPPLEMENTARY NOTATION	

17. COSATI CODES		
FIELD	GROUP	SUB-GROUP
05	09	

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
Econometrics, Enlisted personnel, Incentives, Manpower utilization, Military requirements, Naval personnel, Personnel retention, Productivity, Recruiters, Recruiting, SELRES (selected reserve).

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

The Navy Selected Reserve (SELRES) has experienced enormous growth during the 1980s. The need to meet manpower goals with limited personnel resources places a premium on the effective utilization of the personnel resources within the Selected Reserve. Tools for managing personnel resources include the allocation of recruiters and the efficient use of affiliation and retention bonuses. This memorandum summarizes a series of studies analyzing recruiting and retention in the Naval Reserve, with the objective of helping the Navy meet its manpower requirements at minimal cost.

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☐ UNCLASSIFIED / UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (Include Area Code) / 22c. OFFICE SYMBOL

CNA CENTER FOR NAVAL ANALYSES
A Division of Hudson Institute 4401 Ford Avenue • Post Office Box 16268 • Alexandria, Virginia 22302-0268 • (703) 824-2000

14 December 1988

MEMORANDUM FOR DISTRIBUTION LIST

Subj: Center for Naval Analyses Research Memorandum 88-155

Encl: (1) CNA Research Memorandum 88-155, *Utilization of Personnel Resources Within the Navy Selected Reserve*, by Peter F. Kostiuk, Dean A. Follmann, and Martha E. Shiells, Nov 1988

1. This research memorandum represents the final documentation of a CNA project requested by the Director of the Naval Reserve. It documents a series of analyses of recruiting and retention in the Navy Selected Reserve. Topics investigated include recruiter productivity, the effectiveness of bonuses on enlisted retention, and differences in continuation rates by unit type and rating.

2. Enclosure (1) is forwarded as a matter of possible interest.

Christopher John
Vice President
Navy-Marine Corps Planning
and Manpower

Distribution List:
Reverse page

Subj: Center for Naval Analyses Research Memorandum 88-155

Distribution List

SNDL

A1	ASSTSECNAV, MRA
E3D1	CNR
	Attn: Code 02
	Attn: Code 20
	Attn: Code 21
	Attn: Code 22
	Attn: Code 23
	Attn: Code 10
FF38	USNA
FF42	NAVPGSCOL
	Attn: Superintendent
	Attn: Code 64
FF44	NAVWARCOL
FF67	NAVFITWEPSCOL
FJA1	COMNAVMILPERSCOM
	Attn: Code 9
FKQ6D	NAVPERSRANDCEN

OPNAV

OP-813R
OP-095
OP-951
OP-01B
OP-01B3
OP-01B7
OP-01R
OP-13
OP-606

CRM 88-155 / November 1988

UTILIZATION OF PERSONNEL RESOURCES WITHIN THE NAVY SELECTED RESERVE

Peter F. Kostiuk
Dean A. Follmann
Martha E. Shiells

A Division of CNA Hudson Institute

CENTER FOR NAVAL ANALYSES

4401 Ford Avenue • Post Office Box 16268 • Alexandria, Virginia 22302-0268

ABSTRACT

The Navy Selected Reserve (SELRES) has experienced enormous growth during the 1980s. The need to meet manpower goals with limited personnel resources places a premium on the effective utilization of the personnel resources within the Selected Reserve. Tools for managing personnel resources include the allocation of recruiters and the efficient use of affiliation and retention bonuses. This memorandum summarizes a series of studies analyzing recruiting and retention in the Naval Reserve, with the objective of helping the Navy meet its manpower requirements at minimal cost.

TABLE OF CONTENTS

	Page
List of Tables	v
Background	1
Recruiting Analyses	1
Productivity of Individual Recruiters	5
Retention	6
Naval Reserve Force Retention	12
TAR Manning and Reenlistment Analyses	13
Conclusions	14
References	17

LIST OF TABLES

		Page
1	List of States, by Region and Division	3
2	Average Monthly Enlistments per Recruiter	4
3	Rating Groups, by One-Digit Occupational Category	8
4	Descriptive Statistics, by Rating Group	9
5	Predicted Effect of a $300 Bonus	10
6	Effects of a $300 Bonus on Affiliation and Retention	10
7	Continuation Rates, by Source of Entry	11
8	Surface-Expansion TAR Force Structure	14

BACKGROUND

The Navy Selected Reserve (SELRES) has experienced enormous growth during the 1980s. The need to meet manpower goals with limited personnel resources places a premium on the effective utilization of the personnel resources within the Selected Reserve. Tools for managing personnel resources include the allocation of recruiters and the efficient use of affiliation and retention bonuses. This memorandum summarizes a series of studies analyzing recruiting and retention in the Naval Reserve, with the objective of helping the Navy meet its manpower requirements at minimal cost.

The specific tasks of the study were:

- Estimate the effects of recruiter productivity and other factors influencing the number of accessions into the Selected Reserve
- Analyze the effectiveness of bonuses on the retention of enlisted personnel
- Estimate continuation rates by unit type and rating.

Related objectives were to identify policies or alternatives that would help the Naval Reserve meet manpower goals.

RECRUITING ANALYSES

The allocation of recruiters and affiliation bonus funds are two of the most important mechanisms for influencing enlistments into the Selected Reserve and are also among the few factors under the control of manpower planners. As discussed in [1], several factors complicate the estimation of the effects of variables, such as recruiters and pay, on enlistments into the Naval Reserve. The most important of the complicating factors are: the impact of enlistment goals or quotas; unobserved differences in the propensity to enlist by geographic area or command; and difficulty in obtaining accurate estimates of the civilian employment opportunities available to reservists. Each of these issues and its impact on enlistments will be discussed briefly.

Enlistment quotas create a potentially serious problem in estimating a true enlistment supply curve because of the possibility that recruiters may not work as hard after they have met their contract goals. If this diminution of effort occurs, estimates of the effects of the number of recruiters, as well as of such other variables as pay and unemployment, will be biased. This process can be described in the following example. Suppose that the penalties for not meeting goal are more severe than the rewards for exceeding goal. Then the recruiters are likely to vary their effort in response to market conditions, depending on whether they have met goal. In the extreme case of severe penalties for not meeting goal but no reward for exceeding it, the optimal

behavior of the recruiter will be to stop signing up recruits after meeting goal. In this instance, the estimated parameters will not reflect the true underlying supply curve of enlistments, but will be a combination of the true supply and the quota constraint.

If goals do not respond quickly enough to changing market conditions (or do not adequately reflect differences among geographic regions), the effort of recruiters may vary with the ease of recruiting. Thus, recruiters may work harder in difficult times, relax during other periods, and still meet their quotas. If this phenomenon is not considered, the estimation will result in biased effects of population, unemployment, and the number of recruiters.

Similar problems of bias result from unobserved differences in enlistment propensities among geographic regions or reserve commands. For example, if some areas are more productive, this may be reflected in the allocation of recruiting goals and recruiters. Presumably, more productive areas should have higher goals and more recruiters, so that the unobserved location effect will be positively correlated with both the goal and the number of recruiters. This will produce an upward bias in the estimated effect of recruiters.

The last problem to be discussed is the difficulty of constructing accurate estimates of the civilian employment prospects for potential reservists. The usual proxies for civilian employment opportunities are the overall unemployment rate and some measure of average earnings in the population, such as the Employment Cost Index or average earnings of manufacturing workers, by state. These variables are only rough approximations to the true earnings and employment probabilities experienced by reservists. Overall unemployment rates, even by age group, mask great variation in the population targeted by recruiters. The prime target for reserve recruiters is the recently separated Navy veteran, who tends to be both skilled and relatively young. Age is a particularly important feature of the recruiting market, since evidence shown in [2] indicates that the civilian earnings of young people have deteriorated compared with those of the average worker. Therefore, use of average civilian earnings indices like the Employment Cost Index is misleading, since the experience of the target population differs drastically. This complicates the estimation of pay and unemployment effects.

A detailed discussion of the statistical methodologies applicable to these problems is contained in [1]. Estimates of the various models are contained in [2]. Several findings are worth noting. First, average recruiter productivity differs greatly among geographic regions, and these differences are not constant during the sample period. Table 1 lists the states (including the District of Columbia), grouped into the four regions and nine divisions used by the U.S. Census Bureau. Table 2 summarizes the variations in average monthly contracts per recruiter for the nine census divisions. Two conclusions are immediately obvious. First, all nine divisions show a significant drop in average recruiter productivity during FY 1984, which is probably due to the introduction of the Sea and Air Mariner (SAM) program and a shift in emphasis away from recruiting other supply sources. Second, the western divisions (8 and 9) persistently show higher productivity than the other regions, and the northern divisions (1, 2, and 3) do the worst. The West South-Central division, which includes the oil-producing states

Table 1. List of states, by region and division

NORTHEAST

1 **New England**

Connecticut
Maine
Massachusetts
New Hampshire
Rhode Island
Vermont

2 **Middle Atlantic**

New Jersey
New York
Pennsylvania

NORTH CENTRAL

3 **East North-Central**

Illinois
Indiana
Michigan
Ohio
Wisconsin

4 **West North-Central**

Iowa
Kansas
Minnesota
Missouri
Nebraska
North Dakota
South Dakota

SOUTH

5 **South Atlantic**

Delaware
District of Columbia
Florida
Georgia
Maryland
North Carolina
South Carolina
Virginia
West Virginia

6 **East South-Central**

Alabama
Kentucky
Mississippi
Tennessee

7 **West South-Central**

Arkansas
Louisiana
Oklahoma
Texas

WEST

8 **Mountain**

Arizona
Colorado
Idaho
Montana
Nevada
New Mexico
Utah
Wyoming

9 **Pacific**

Alaska
California
Hawaii
Oregon
Washington

of Texas and Louisiana, became much more productive during the last few years. It is noteworthy that an identical pattern can be found in active-duty recruiting [3], indicating that the differences in preferences for military service vary by division, or that economic conditions have a similar impact on recruiting for the two components. Evidence shown in [2] indicates that geographical differences in the levels of and changes in both unemployment rates and civilian earnings can partially explain the differences in average recruiter productivity.

Table 2. Average monthly enlistments per recruiter

	Fiscal year				
Division	1983	1984	1985	1986	All years
1	5.2	3.3	3.6	3.7	3.9
2	4.8	3.2	3.6	3.9	3.8
3	4.6	3.0	4.0	3.7	3.8
4	4.8	3.3	3.7	4.0	3.9
5	4.9	3.5	4.1	4.5	4.2
6	4.3	3.2	4.3	4.3	4.0
7	4.1	2.9	3.8	4.2	3.8
8	4.7	4.0	4.3	4.2	4.3
9	5.7	3.9	4.0	4.7	4.5
All	4.9	3.4	3.9	4.2	4.0

Knowledge of differences in average recruiter productivity is important for making decisions on where to place reserve units and in evaluating the performance of commanding officers and recruiters. Given enough flexibility, the Naval Reserve could substantially increase the number of contracts without any change in the number of recruiters by reallocating units or billets. Constraints on movements in units limit to some extent the potential gains from such management actions. However, recent proposals to increase the flexibility of the assignment process[1] would increase the ability of the recruiting establishment to maximize enlistments with current resources.

An important policy variable determining the number of accessions is the number of recruiters. To disentangle the effects of recruiters, population size, and pay requires a detailed statistical analysis. A number of the statistical models described above are estimated in [2]. The findings of the most plausible model show that the number of recruiters has a strong positive

1. An example is the "billet-to-the-reservist" concept.

effect on enlistments, with an elasticity of enlistments with respect to recruiters of about 0.5.[1] This implies that an increase of 10 percent in the recruiter force is predicted to increase enlistments by about 5 percent. The estimates vary somewhat, depending on which model specification is used.

The effects of other variables were also estimated. One of the more intriguing findings is that, after the correlations between quotas and the other variables are controlled for, as well as measurement errors in pay, quotas have no impact on enlistments. This finding may be due to the emphasis placed on reserve enlistments during the last several years. The effects of population size are less than proportional but imprecisely measured. The most plausible estimates indicate a population elasticity in the range of 0.30 to 0.85.

The analysis also found that a one-point increase in the unemployment rate is expected to increase enlistments by about 3 percent. Pay effects were especially difficult to estimate, but once properly specified, it was found that the elasticity of pay with respect to enlistments was 0.82. That is, an increase of 10 percent in the ratio of reserve to average civilian earnings is expected to raise enlistments by 8.2 percent. This result is roughly consistent with the estimates obtained in [4] using individual affiliation data.

PRODUCTIVITY OF INDIVIDUAL RECRUITERS

An important aspect of the effect of varying the number of recruiters, and the productivity of recruiters in general, is how productive each recruiter is. As discussed in the previous section, numerous factors can affect the productivity of the recruiting force: the population of Navy veterans in the area, local unemployment rates and wage levels, and the propensity for military service in different regions of the country. Some of these factors can be controlled for in a statistical analysis, but still other, unmeasured effects are more difficult to control for. In particular, the variance in productivity of individual recruiters may be large, even after controlling for local market conditions. Some recruiters, for example, may just naturally have the combination of qualities that make a good recruiter, while others are less adept at persuading potential reservists to enlist. Perhaps more important for evaluating the effect of changing the size of the recruiting force is the time required to become a fully productive recruiter. If this period is substantial, then new recruiters will not be as productive as more experienced ones, and estimates of the impact of increasing the number of recruiters will be biased because they do not take this into account.

An analysis of the factors influencing individual recruiter productivity is contained in [5] and [6]. Using data on monthly contracts obtained by a sample of recruiters, the analysis showed that recruiter productivity involves a significant learning period and varies widely. Recruiters with two years of experience are about twice as productive as new recruiters, with about

1. An elasticity is defined as the percentage change in enlistments resulting from a 1-percent change in the number of recruiters.

85 percent of the productivity increase occurring during the first 12 months on recruiting duty. This has two important implications for recruiting policy. First, since new recruiters take time to learn their jobs, periods with large increases in the number of recruiters will see a reduction in average productivity. This probably occurred during 1984 when the recruiting force grew substantially and average productivity declined (see table 2). Expecting new recruiters to be as productive as experienced ones will overestimate the number of enlistments. The second policy implication is that the effects of changing the number of recruiters are not symmetric. When the recruiting force is increased, average productivity will decrease because of the influx of inexperienced recruiters, while decreases in the recruiting force will probably have little effect on productivity, and may even rise, if only poor recruiters are eliminated. Although the available data make a detailed analysis imprecise, some evidence indicates that controlling for variations in average recruiter experience raises the estimated recruiter elasticity by about 10 percent, or from 0.53 to 0.58.

Another significant finding is that the average productivity of recruiters varies greatly. Some recruiters are perennially more productive, while others never attain high levels of production. Even for good recruiters, however, the number of contracts varies greatly from month to month, due to the uncertain nature of the recruiting business. An encouraging finding of the study is the evidence that indicates that it is the less productive recruiters who tend to leave the recruiting force, whether it is a voluntary or involuntary departure. This is important, since it increases the average quality of the recruiting force.

The study found that recruiting resources are an important factor in determining Selected Reserve enlistments. Both through their total numbers and individually, through the effects of experience, recruiters have significant impacts. Reserve pay is also important, although its effect is difficult to estimate accurately with aggregate data. The analysis in [4], using data on individual affiliation decisions, indicates that affiliation bonuses have a significant effect on affiliation rates.

RETENTION

As a complement to the analysis of recruiting, the study also examined factors affecting retention. Three specific areas were addressed: the effect of pay and bonuses on retention; the differences between unit types in retention rates, with the primary distinction being between Naval Reserve Force (NRF) and non-NRF units; and the reenlistment of Training and Administration of Reserves (TAR) personnel.

The analysis of retention focused on the behavior of Navy veterans because they are the largest single source of manpower for the Naval Reserve. Veterans are also generally the preferred source of manpower for the Selected Reserve, having already obtained valuable training and experience while on active duty. The quality of the available data on veterans is also better, and most of the bonus programs are designed to attract veterans. Focusing on veterans also provides a useful comparison with existing analyses of affiliation contained in [4].

Most studies of retention of active-duty personnel examine decisions at the reenlistment point. Such models are inappropriate for analyzing reserve retention because the reenlistment point is ambiguous. Although veterans affiliating with the Selected Reserve sign contracts, attrition from the reserves shows little relation to formal contract expiration dates. Because no reenlistment point is relevant to a study of reserve attrition, the approach used in this study was to examine the probability of an individual remaining in the Selected Reserve for a specified period of time. Because retention is usually lowest during the first year in the reserves, a logical starting point is to analyze attrition during the first year.

The sample used in the analysis consists of Navy veterans who separated from active duty in fiscal years 1981 through 1985. Only first-term veterans are included, and all must have been eligible for reenlistment. Separations were identified from the Enlisted Master Record, along with personal characteristics and military records, such as rating and paygrade. Enlistment and retention data were obtained from the Reserve Common Component Personnel Data System (RCCPDS). Information on bonus eligibility is contained in the series of Reserve Recruiting and Manning Objective System (RAMOS) instructions issued by Commander, Naval Reserve Force, to set enlistment goals and rating categories. Bonus eligibility is determined by an individual's rating and length of service, and the list of bonus ratings is updated regularly.

The pay variable used in the statistical analysis is the sum of reserve drill pay and any affiliation bonus that the reservist qualifies for. It is important to note that the imputed bonus pay is based on whether an individual qualifies for a bonus, not whether a bonus is actually received. For most of the sample period, data are insufficient to determine which reservists actually received bonuses. This indeterminacy may cause the estimated effect of pay to be understated.

The personal characteristics used to control for differences in civilian opportunities and tastes for the military are sex, race, education, paygrade, and marital status. The analysis in [4] found that women and nonwhites were more likely to affiliate. These behavioral differences may also affect retention, so controls for sex and race are included. Many studies of attrition in the military have found significant differences in retention between high school graduates and nongraduates, and this effect is estimated.

The Naval Reserve contains a large number of ratings among which retention behavior may differ. To examine the differences, the Navy ratings are segmented into 11 occupational groupings, each of which is estimated separately. This allows for variations in the effects of pay and other variables on retention. There is little reason to expect that hospital Corpsmen (HM), for example, will respond the same way to pay changes as builders (BU) or seamen (SN). Table 3 lists the occupational groups used in the analysis, along with the ratings included in each.

Table 3. Rating groups, by one-digit occupational category

Category	Rating group	Ratings within group
1	Seamanship	BM, GMG, QM
2	Electronic equipment repair	AQ, AT, AX, CTM, DS, ET, FT, MT, ST, TD, TM
3	Communications/intelligence	AC, AW, CTI, CTO, CTR, CTT, EW, IS, OS, OT, RM, SM
4	Medical	DT, HM
5	Other technical	AG, DM, EA, MU, PH
6	Administrative/clerical	AK, AZ, CTA, DK, DP, JO, PC, PN, RP, SK, YN
7A	Mechanical equipment repair—aviation	AB, AD, AE, AM, AO, AS
7S	Mechanical equipment repair—surface	BT, CM, EM, EN, GMM, GMT, GS, IC, IM, MM, MN, OM
8	Craftsmen	BU, CE, EO, HT, LI, ML, MR, PM, SW, UT
9	Service/supply	MS, PR, SH
10	Unrated	AN, CN, FN, SN

Some sample characteristics, by rating group, are in table 4. Of most interest in table 4 are the differences in first-year continuation rates across the rating groups. The highest retention is in group 4, which consists of the medical ratings; the lowest retention group is Group 7A, mechanical equipment repair—aviation. The difference between the highest and lowest continuation rates is 13.7, which indicates a fairly large degree of variation in retention behavior.

The complete documentation of the statistical analysis of retention is contained in [7]. Table 5 summarizes the estimated impact of a $300 bonus on retention for the rating groups with significant estimated pay effects. The rating groups that do not show a statistically significant effect of pay on retention are medical (Group 4), mechanical equipment repair—aviation (Group 7A), service and supply (Group 9), and unrated (Group 10). Possible reasons for the lack of an estimated pay effect for these groups are the limited variation in pay within each group (especially the unrated group, in which all personnel are in paygrade E-3 and receive no bonus) and actual behavioral differences.

Table 4. Descriptive statistics, by rating group

	Rating group										
	1	2	3	4	5	6	7A	7S	8	9	10
Number of observations	1,883	2,387	3,653	3,129	409	2,997	3,206	7,113	1,960	1,112	1,189
Continuation rate (percent)	49.7	59.8	54.3	61.5	58.9	55.2	47.8	51.4	50.4	53.8	49.9
Average paygrade	4.3	4.8	4.6	4.2	4.5	4.4	4.3	4.4	4.6	4.1	3.0
Average pay (thousands of 1986 dollars)	2.1	2.1	2.1	2.1	2.1	2.0	1.9	1.9	2.1	2.0	1.7
Percent nonwhite	17.5	9.7	19.5	19.0	10.3	25.5	24.6	19.4	8.7	25.3	35.4
Percent female	4.0	6.4	16.7	30.0	35.9	42.9	6.0	4.0	3.7	17.2	10.3
Percent nongraduate	23.7	9.3	11.1	7.9	8.1	11.0	15.2	14.8	15.1	15.2	24.7
Percent married	31.7	31.6	28.9	37.5	35.7	37.2	31.4	31.1	33.8	32.3	26.7
Average time since affiliation (months)	8.1	8.7	7.2	6.0	7.7	8.1	9.0	9.0	9.1	8.8	8.8

Table 5 is useful for summarizing the effect of pay on first-year retention. It shows that for most of the rating groups the impact of a $300 bonus is sizable, with predicted continuation rates rising by several points. The effects listed in table 5 also demonstrate the differences among rating groups in both average continuation rates and sensitivity to pay changes.

The estimated effects of pay shown in table 5 actually underestimate to a large degree the net effect of a bonus on SELRES manpower. The bonuses used by the Naval Reserve are actually affiliation bonuses, although, as this analysis has shown, they also affect retention. To evaluate the true effect of an affiliation bonus, the cumulative effects of the bonus on both affiliation and retention must be taken into account. For example, this analysis of retention indicated that attrition of hospital corpsmen (in rating group 4) was unaffected by pay. However, previous CNA research [4] showed that rating group to have affiliation rates that were strongly affected by pay. Focusing solely on retention or affiliation may provide a misleading picture of the total effect of a bonus on achieving manpower goals.

Table 5. Predicted effect of a $300 bonus

Rating group	Average continuation rate without bonus	Continuation rate with bonus
1	49.7 (1.2)	53.7 (2.1)
2	60.2 (1.0)	65.4 (2.1)
3	54.5 (0.8)	58.2 (1.5)
5	59.7 (2.5)	68.0 (4.7)
6	55.4 (0.9)	59.1 (1.8)
7S	51.5 (0.6)	55.3 (1.5)
8	50.5 (1.2)	55.4 (2.1)

NOTE: Standard errors, in parentheses, were computed using the delta method.

A more complete description of the effect of a $300 bonus is provided in table 6.

Table 6. Effects of a $300 bonus on affiliation and retention

	Number affiliating		Number remaining one year[a]	
Rating group	Without bonus	With bonus	Without bonus	With bonus
1	13	17	6.5	9.1
2	8	9	4.8	5.9
3	14	17	7.6	9.9
4	22	27	13.6	16.7
5	11	11	6.6	7.5
6	11	16	6.1	9.5
7A	10	10	4.8	4.8
7S	6	6	3.1	3.3
8	10	11	5.1	6.1
9	12	12	6.5	6.5
10	10	10	5.0	5.0

NOTE: The effect of the bonus on affiliation is taken from [4], table 8, page 28.

a. Number refers to those remaining out of a hypothetical population of 100 Navy veterans.

The table shows the estimated impact of a $300 bonus on the affiliation and retention rates of a notional group of 100 Navy veterans leaving active duty. The predicted effect of the bonus on affiliation and retention is shown for each rating group. As the table shows, the variation among rating groups is substantial, due to differential responses to the bonus at affiliation and differential responses to the bonus on retention. The rating groups also vary significantly in their average continuation rates. For the medical rating group, 4, for example, a bonus strongly affects affiliation but has little impact on retention. The large number remaining after one year is attributable to the high baseline affiliation rate and the response of affiliation to the bonus. Rating group 5, on the other hand, shows no effect of the bonus at affiliation but shows a positive effect on retention. Rating groups 9 and 10 are insensitive to pay during both the affiliation and retention decisions.

The results of this analysis are a strong indication that affiliation bonuses play an important role in shaping SELRES manpower. Most ratings are affected by pay changes at affiliation or retention, and possibly both. Furthermore, the wide variation in average continuation rates, combined with the estimated effects of bonuses, shows that targeted bonuses can be an effective manpower force management tool for the Naval Reserve. It is critically important for manpower planning that affiliation and retention policies be addressed simultaneously, with allowances for behavioral differences among rating groups.

Although Navy veterans are the most numerous source of manpower for the Selected Reserve, they are not the only source. Significant numbers of enlistments come from Active Mariners (AM), Sea and Air Mariners (SAMs), Advanced Paygrade (APG) personnel, and Other Service Veterans (Osvets). The retention behavior among these groups differs significantly, as shown in table 7.

Table 7. Continuation rates, by source of entry

Year of service	NAVET	AM	SAM	APG/OS	All
1	62.95	81.34	93.12	82.73	76.69
2	69.69	66.32	84.74	77.42	73.50
3	75.35	33.88	93.37	78.43	65.72
4	72.54	76.25	–	68.76	72.96

The table shows that SAMs have the highest continuation rates, as would be expected given their strong contractual obligation. Active Mariners also have high first-year retention rates, but

they fall off sharply after the initial year of service. APGs and Osvets have continuation rates much higher than Navy veterans. They provide an important source of enlistments for several critical ratings, such as HM and the Seabee ratings, and the high retention rates show that they are a reliable source of manpower. Since in many cases the enlistments of APGs and Osvets are limited by Navy policies and recruiting quotas, it would be useful to examine those policies to determine whether they represent desirable limitations or can be relaxed to permit more enlistments.

NAVAL RESERVE FORCE RETENTION

Most studies of manpower availability (see [8] and [9]) assume that continuation rates are the same across ratings and units. As the analysis in the preceding section showed, continuation rates differ among rating groups in the Selected Reserve. Another possible complication is that continuation may differ among units, and in particular that Naval Reserve Force (NRF) retention may be lower because of the more arduous nature of the duty. If the differences are significant, then the manpower forecasts now used for planning purposes should be modified to account for this.

NRF retention rates are analyzed and compared with non-NRF units in [10]. The results show that in fiscal years 1986 and 1987, 42.3 percent of the NRF personnel inventory left NRF units each year. Because 10.7 percent of the personnel transferred to non-NRF units, the SELRES loss rate for NRF personnel was 31.6 percent. This compares to an annual loss rate of 28 percent for all SELRES personnel. Although the difference may not seem large, relative to non-NRF units NRF units have more people with longer terms of SELRES service and more people with SELRES obligations (primarily Sea and Air Mariners). If NRF and non-NRF units had similar compositions, then the loss rates for NRF units would be even higher. The evidence therefore indicates that retention is worse on NRF ships than in other SELRES units.

Some other findings of the analysis in [10] should be useful to reserve manpower planners. First, despite policy decisions to eliminate the use of cross-assignment on NRF ships, cross-assigned personnel are still common on NRF ships. Second, the three-year assignment to NRF units appears to have little effect on the timing of attrition.[1] During the sample period, over half of the people who transferred out of NRF units did so during the first year, and almost 80 percent during the first two years. Only 10 percent of all transfers took place within six months of the three-year rotation point. For losses to SELRES from NRF units, over 40 percent left after having served less than one year with the unit.

Other factors that affect retention of NRF personnel and were analyzed are crew type (main, alternate, or pre-crew), ship class, and geographic location. Statistical analysis suggests that continuation rates do not differ among main, alternate, and pre-crews. Only weak evidence suggests that rates differ by ship class or by geographical region as measured by the Naval

1. SELRES policy calls for three years of NRF duty followed by rotation to a non-NRF unit.

Reserve Readiness Command (REDCOM). Therefore, forecasts of personnel availability would be improved only marginally by incorporating geographic differences in retention. Furthermore, changes in the types of ships that are in the NRF are not likely to affect continuation rates very much.

The analysis also found large differences in continuation rates across paygrades and by length of service (LOS). Continuation rates rise with LOS, with retention rates of 48.8 during the first year and 70.9 for those with over six years of service. Little evidence suggests large differences in continuation rates by rating, however—at least within NRF units.

An important consideration in evaluating retention rates in the Naval Reserve is the quality of the data used and the methods used to adjust the raw data. Records from the Inactive Enlisted Master File (IEMF) must be adjusted to account for people who lose their mobilization billets or are cross-assigned and for crews that are restructured. In this study, continuation rates increased from 34.7 to 57.7 percent annually when the appropriate adjustments were made.

TAR MANNING AND REENLISTMENT ANALYSES

An important issue for the Naval Reserve is how to man the NRF. The previous section identified some of the issues involved in the use of SELRES crew members on NRF ships. But in addition to SELRES crew members, NRF ships are manned by active-duty and TAR personnel. As part of this study, CNA investigated some of the manning issues in the TAR program and developed a manpower forecasting model to assist planners and policy makers. As part of the analysis, TAR reenlistment rates were compared with those in the regular Navy.

Meeting TAR manpower requirements is critical for effective management of the reserve program and for manning NRF ships. One of the findings documented in [11] is that, although the supply of non-prior-service accessions is plentiful, meeting veteran accession goals has been difficult. The number of TAR veteran accessions is sensitive to regular-USN Selective Reenlistment Bonus (SRB) levels, with a one-level SRB increase being associated with a 17-percent drop in accessions to the TAR program. On the other hand, high regular-USN SRBs do not seem to have a similarly negative impact on retention within the TAR surface-expansion program. In most cases, as shown in [11] and [12], retention rates for TARs exceed rates for their regular-USN counterparts.

Reference [11] developed a TAR manpower projection model that can be used to see wnether future requirements can be met under current policies and conditions, or if they can be met if certain policies are adopted. The base case suggests that overall fiscal 1991 requirements can be met in the nine original surface-expansion ratings. A large shortage will result in paygrades E4 through E6 (see table 8), however, but that will be balanced by a surplus in paygrades E1 through E3. One method, then, of meeting total requirements would be to substitute low for middle and junior paygrade personnel. The desirability of this policy depends on whether the TAR community can carry out its mission with a more junior force

structure and whether the training received by first-term personnel is adequate for the greater responsibility.

Table 8. *Surface-expansion TAR force structure*

	Requirements		Base-case inventories	
	1989	1991	1989	1991
E1 to E3	349	360	1,502	1,502
E4 to E6	4,234	4,413	2,528	3,247
E7 to E9	733	753	491	756
Total	5,316	5,526	4,521	5,505

NOTE: Includes ratings BM, BT, EM, EN, ET, HT, IC, MM, and MR.

Two possible policies for increasing middle-paygrade inventories are paying reenlistment bonuses and paying affiliation bonuses. Because TAR retention rates are high and the population of TARs is small, extending the regular-USN SRB policy to TARs would not be an effective method of raising inventories. A more appropriate policy targeted toward the TAR community would be to increase veteran accessions by offering affiliation bonuses. A $2,500 affiliation bonus is predicted to increase accessions in paygrades E4 through E6 by 31 persons per year. This would increase fiscal 1991 middle-paygrade inventories to 76 percent of requirements, compared to 74 percent in the base case. No reasonable amount of bonus money can be expected to eliminate the entire gap between middle paygrade inventory and requirements. The affiliation bonus should therefore be combined with either a slower increase in requirements or an increased reliance on lower-paygrade personnel.

CONCLUSIONS

The findings of this study point to several ways for achieving Naval Reserve manpower goals. In the area of recruiting, the allocation of recruiters and the use of affiliation bonuses should be useful in achieving overall endstrength goals and targeted enlistment objectives for particular ratings. One source of concern is the variation in recruiter productivity among geographic regions, which may make it more difficult to attain recruiting objectives in low-productivity regions, such as the Northeast. Given the constraints on the location and mobility of reserve units, offsetting this effect by moving recruiting resources (as the regular Navy has done) has limited potential. One possible solution would be to use affiliation bonuses targeted to specific geographic areas or units, such as the Northeastern states or to units in

hard-to-recruit regions. Such a bonus program could be combined with bonuses targeted toward high-priority units, such as the NRF. Given the already low retention in NRF units, such a program could be costly.

With the recent emphasis on upgrading quality in the Selected Reserve, it will be useful to combine the results of this study with recently developed geographic attainability models. The results should be valuable for both the selection of new unit locations and for forecasting manpower inventories. The value of such models depends critically on the accuracy of information on recently separated Navy veterans, which was not available at the time of this study. Development of more accurate and timely data bases would enhance the recruiting efforts of COMNAVRESFOR and increase the forecast accuracy of inventory projection models now used by reserve manpower planners.

Since geographic limitations play an important role for both reserve recruiting and retention, any policy that will loosen this constraint deserves close scrutiny. For example, the flexibility provided by a "billet-to-the-reservist" concept may ease considerably the constraints placed on reserve recruiters by increased quality goals. It may also offset to some extent the impact of maintaining units in regions where recruiting is difficult.

REFERENCES

[1] CNA Research Memorandum 87-145, *Issues in Estimating Enlistment Supply*, by Peter F. Kostiuk, Aug 1987 (27870145)[1]

[2] CNA Research Memorandum 87-239, *Enlistment Supply into the Naval Reserve*, by Peter F. Kostiuk and James E. Grogan, Dec 1987 (27870239)

[3] CNA Research Memorandum 88-21, *Geographic Variation in Recruiter Productivity:* FY 1984-1986, by Timothy W. Cooke, Feb 1988 (27880021)

[4] CNA Research Memorandum 86-249, *Affiliation of Navy Veterans With the Selected Reserve*, by Martha Shiells, Dec 1986 (27860249)

[5] CNA Research Memorandum 87-240, *Naval Reserve Recruiter Experience and Productivity*, by Peter F. Kostiuk and Dean A. Follmann, Dec 1987 (27870240)

[6] CNA Research Contribution 584, *Learning Curves, Personal Characteristics, and Job Performance*, by Peter F. Kostiuk, Dean A. Follmann, and James E. Grogan, Mar 1988 (02058400)

[7] CNA Research Memorandum 88-72, *Retention of Navy Veterans in the Selected Reserve*, by Peter F. Kostiuk and Dean A. Follmann, May 1988 (27880072)

[8] CNA Research Memorandum 85-73, *Manning the Naval Reserve Force*, by Beth J. Asch, Oct 1985 (27850073)

[9] CNA Research Memorandum 87-30, *Summary of the Active/Reserve Force Mix Study*, by Martha E. Shiells and Jean W. Fletcher, Feb 1987 (27870030)

[10] CNA Research Memorandum 88-29, *Retention in the Naval Reserve Force*, by Martha E. Shiells and David L. Reese, Feb 1988 (27880029)

[11] CNA Research Memorandum 87-159, *Manning Issues in the Surface-Expansion TAR Program*, by Martha E. Shiells, Aug 1987 (27870159)

[12] CNA Research Memorandum 87-244, *Retention Behavior of Enlisted TARs in Surface-Expansion Ratings*, by Monica Hayes, Dec 1987 (27870244)

1. The numbers in parentheses are internal CNA control numbers.